Venomous Snakes of Nepal

A photographic guide

S.K. Sharma, D.P. Pandey, K.B. Shah, F. Tillack,
F. Chappuis, C.L. Thapa, E. Alirol & U. Kuch



If you are bitten by a snake

1. Don't panic. Most snakes are not dangerous, and even those that are dangerously venomous often do not inject venom when they bite a person.
2. Don't risk further bites or delay appropriate treatment by attempting to search, capture or kill the snake. However, if the snake is already killed, it should be carried safely along with the patient to the treatment centre for identification.
3. Immobilize the bitten limb with a splint or sling and keep it still.
4. Don't run. If possible, let others carry you immediately (preferably by motor vehicle) to the nearest health centre where anti-snake venom serum is available. Using a motorcycle will help to save time.
5. Don't cut, burn or suck the bite site or the bitten body part.
6. Don't use herbs, chemicals, ice/cool packs or electric shocks.

यदि तपाईंलाई सर्पले डसेको छ भने

१) हतोत्साहीत नहुनुहोस्, साह्रै पीर नगर्नुहोस्, धेरै जसो सर्पहरु विषालु हुदैनन् र अझै भन्ने हो भने खतरनाक विषालु सर्पहरुले पनि मानिसलाई डसेको खण्डमा प्राय: आफ्नो विष डसेको ठाउँमा पसाउँदैनन् ।

२) सर्पलाई समाउन वा मार्न खोजेर अर्को डसाईको खतरा नमोल्नुहोस् र सर्पलाई खोजेर उपयुक्त उपचारको लागि ढिला नगर्नुहोस् । यदि सर्पलाई अघिनै मारिसकिएको छ भने, त्यसको पहिचानको लागि मरेको सर्पलाई विरामीसँगै उपचारकेन्द्रमा सुरक्षित तवरले लैजानुहोस् ।

३) सर्पदंश भएको हात-खुट्टालाई एउटा 'स्प्लीन्ट' वा 'स्लीङ्ग'को सहायताले अचल बनाउनुहोस् र त्यसलाई स्थीर राख्नुहोस् ।

४) नदौडनुहोस् । तपाईलाई अरु कसैले तत्कालै (खासगरी मोटरगाडीबाट) प्रतिविष (विष प्रतिरोधात्मक औषधि) उपलब्ध हुने नजिकैको स्वास्थ्य केन्द्रमा लैजान लगाउनुहोस् । मोटरसाइकलको प्रयोगले समय बचाउन सहयोग गर्ने छ ।

५) विषालु सर्पले डसेको ठाउँमा काट्ने, चुस्ने र आगोले डाम्ने काम नर्गनुहोस् ।

६) जडिबुट्टिहरु, रसायनिक पदार्थहरु, वरफ/चिसो पोकाहरु वा बिजुलीको झट्का लगाएर उपचार गर्ने काम नर्गनुहोस् ।

७) डसेको ठाउँबाट रगतलाई कुनै यन्त्रको सहायताले तान्ने गर्नु हुँदैन ।

८) प्रारम्भिक अवस्थामा खुर्सानी खाएर सर्पले डसेको थाहा हुँदैन, यसले त पेट पोलेर उपचारमा झन बाधा पुऱ्याउँछ ।

९) कुखुराको मलद्वार डसेको ठाउँमा लगाउँदा विष चुस्छ भन्ने धारणा गलत हो ।

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Foreword

I am pleased to introduce and welcome this guidebook on the venomous snakes of Nepal. This important new book demonstrates with excellent photographs, the colourful natural beauty and biodiversity heritage represented by – cobras, kraits, coral snakes and vipers.

Although snakes are widely recognized as farmers' friends because they efficiently control rodent populations, their bites also cause immense suffering among the rural populations of South Asia. This is also the case in Nepal where snake bites have always been a great public health concern in the lowlands. However, due to global warming, some venomous snakes of our lowland regions could in the future also cause problems in the hills where people may not yet be prepared for this. Thus, we wish this book to be distributed and used in the entire country.

The Government of Nepal through its Ministry of Health and Population has responded to the needs of snake bite patients in Nepal by distributing life-saving anti-snake venom immunoglobulin drugs, free of charge to hospitals and snake bite treatment centres, and by imparting training for health professionals in the country. We are fully committed to continuing and expanding these activities. It is also recognized that several aspects of the prevention and clinical management of snake bite in Nepal requires further investigations and that progress in scientific research on these matters may in the future lead to changes in the guidelines.

In this sense, it is our great pleasure to receive this book as another example for the outstanding success of international collaboration between medical doctors and biologists from Nepal, Switzerland and Germany whose tireless efforts have contributed so much to improve our knowledge and treatment of overlooked and neglected snake bite disease.

It is our sincere expectation that the diffusion of the information provided in this book will contribute to the environmental and health education of the people and to improve the situation of the snake bite in Nepal. We also express our hope that the publication of this book will increase awareness and stimulate much needed additional scientific research on this subject.

(Dr. Praveen Mishra)
Secretary

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Foreword

Since ancient times, snakes have been worshipped, feared, or loathed in Nepalese society. Especially cobras appear in many tales and myths and are regarded as sacred in different religions and cultures. Indeed, snakes play a very important role in agriculture, being the best natural controllers of rats and mice and therefore securing harvests and income, and limiting the spread of rodent-borne diseases.

Unfortunately, snakes at the same time are also a painful reality in the daily life of millions of villagers in Nepal where envenoming following snake bites is a very common and serious public health problem. Throughout the South Asian region, lack of knowledge about venomous snakes, first aid measures and medical treatment, along with limited access to quality care and specific essential medicines, result in high morbidity and mortality.

Here, the Embassy of Switzerland in Nepal and the Swiss Agency for Development and Cooperation SDC present for the first time in Nepal a photographic guidebook that is entirely devoted to the venomous snakes of this country and the important questions of how they can be distinguished from each other and from harmless non-venomous snakes, how bites by such snakes can be avoided, and what can be done to obtain the best treatment result if one is bitten.

By sponsoring the publication and distribution of this booklet, prepared by a team of experts from Nepal, Switzerland and Germany, we hope to increase the knowledge of the rich biodiversity of Nepal and the respect for this ecologically, economically and medically important group of animals. Better knowledge of snakes, their distribution, habitats and behaviour, and of practicable ways of preventing their bites, is necessary to reduce the high number of snake bites in Nepal. At the same time, knowing what to do and what not to do after a snake bite is crucial for reducing snake bite morbidity and mortality. Finally, in the snake bite clinic or hospital, knowing which species of snake had caused the bite can play a very important role for treatment decisions. We hope that this book will serve all these purposes.

Numerous aspects of the venomous snakes of Nepal, including their geographical distribution and diversity, are still unknown. Almost none of their venoms have been analyzed scientifically, and from some species even not a single proven case of envenoming is known. Hopefully scientific research in this field will be dynamic enough to generate new data soon. Then, in a few years this book may be updated for the benefit of the Nepali people.

EMBASSY OF SWITZERLAND IN NEPAL

Thomas Gass
Ambassador and SDC Country Director
Embassy of Switzerland in Nepal

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U. Kuch

Fig. 1. Spectacled Cobra (*Naja naja*).

What is a snake?

Snakes are limbless reptiles having an elongated body covered with scales which are arranged in rows. The form, structure and arrangement of these body scales are important for snake species identification. Snakes are different from birds and mammals in many ways. They are vertebrate animals too (with an inner skeleton), but birds and mammals are warm-blooded animals which can maintain their body temperature stable despite changing temperatures in the environment. However, snakes are cold-blooded animals and under normal circumstances they have to regulate their body temperature by choosing appropriate places in their environment (e.g., by sun bathing or hiding in holes), so they are very sensitive to weather and climatic changes and other ecological or environmental conditions.

Which other animals look similar to snakes?

Superficially, some snakes look similar to certain fishes, e.g., eels. However, fishes have gills and typically use these for breathing, whereas snakes breathe via lungs throughout their life. Also, many eels move in the water with the help of fins (which snakes do not have), and they do not have scales on the body like snakes.

Earthworms are sometimes confused with snakes but they have no interior skeleton of bones and no protective scales covering the body; instead they have rings on their body which snakes do not have. So-called worm or blind snakes that often are of similar size and shape as earthworms do


K. B. Shah

Fig. 2. Common/Brahminy Worm Snake (*Ramphotyphlops braminus*) from Kapilvastu District, Nepal.

have these scales (just very small and shiny ones, see Fig. 2), and even poorly developed eyes visible as dark spots on the head.

Limbless amphibians also have distinct rings on their bodies, but they have a bony skeleton, and visible eyes on the head. Unlike frogs and salamanders, limbless amphibians have body scales that are embedded in the skin along the ring grooves.

From lizards, snakes differ in various ways. Snakes do not have legs, but lizards typically have legs. Snakes have no external ears, but lizards have external ear openings that are usually well visible. Most lizards, including those species that have a snake-like body without limbs, have moveable eyelids so they can close their eyes. In snakes, there are no moveable eyelids. Instead, the eye is covered by a transparent disc-like scale for protection. The same type of eye without eyelid is also seen in certain lizards like the common house gecko. Finally, snakes have tongues with forked tips. As they use their tongue to detect odours in their environment, having a forked tongue allows them to determine if a scent trace on the ground that was made by a prey animal turned to the left or right side, so they can follow it with greater precision. Among the common lizards of Nepal, monitor lizards (family Varanidae) also have tongues with forked tips, but these large lizards have four very well developed legs, well visible external ears, and moveable eyelids.

How many different species of snake are there?

There are more than 3400 different species of snake on earth. Snakes can be found on all continents except Antarctica, and they have conquered the most divergent environments from the mountains of the Himalayas to the coral reefs of the Pacific Ocean. There are snakes that spend all of their life in the water, others that live underground in holes and burrows that they or other animals have dug, and yet others that spend their lives high up in the canopy of trees. Most snakes reproduce by laying eggs but some species give birth to fully developed young. Certain species of snake like pythons or the king cobra even guard and protect their eggs. Snakes exclusively eat other animals, and many species are capable of swallowing prey that is very big or bulky compared to their own body. By controlling the number of other animal species, and by serving as food to others like birds of prey and other predators (e.g., mongoose), snakes play an important role in the natural ecosystems and artificial agro-ecosystems. For farmers, snakes are very useful because they help to control rodent populations by eating the rats and mice that would otherwise damage crops or eat stored food.

Which snakes are dangerous for humans?

Most species of snake are harmless for humans. Many have no venom at all, and they either kill their prey by constriction or by pressing it to the ground, or simply swallow it alive. Many others produce secretions in specialized oral glands that help them to immobilize, kill and/or digest their prey and to act against harmful bacteria. From a biological point of view, these oral gland secretions are usually called venoms (and the glands in which they are produced, venom glands) if the snakes use them to quickly immobilize or kill their natural prey. This is usually achieved if the snakes do not only have toxic oral gland secretions, but also an effective venom apparatus to deliver these into their prey or enemy. The teeth of snakes play a key role in this.

The most primitive type of dentition of snakes consists of teeth that are of similar size and shape anywhere in the mouth. Many snake species have a more differentiated dentition in which certain teeth are longer and have blade-like ridges or grooves. These can facilitate the penetration of the teeth into the prey and/or the application of toxic oral gland secretions. A large number of snake species has such enlarged teeth in the back of the upper

jaw. Under usual circumstances, these so-called "rear-fanged snakes" cannot effectively apply their toxic oral gland secretions to human bite victims.

The most sophisticated and effective venom apparatus, the so-called front-fanged venom apparatus, is composed of the following parts:

1. Two much enlarged teeth for venom injection (also known as fangs) in the front of the upper jaw of the mouth.
2. A venom duct that connects each fang with one well-developed venom gland located behind the eye on each side of the head.



U. Kuch

Fig. 3. Green pit viper (*Trimeresurus* sp.) showing the venom fangs.

Worldwide less than 700 species of snake have this type of venom apparatus, and only a fraction of these is actually of significant medical concern.

How can dangerously venomous snakes be distinguished from others?

Recognizing which snake is dangerously venomous and which one is not is often difficult for non-experts. However, there are certain external features that can be very useful for distinguishing dangerous species from harmless ones even if they look superficially similar. In this section we will discuss and illustrate some of the most relevant ones in the context of Nepal.

Green snakes

In Nepal there are several species of snake with variable shades of light or dark green colouration, but only some of these are dangerous. Some important characteristics can be used to distinguish these:

1. In Nepal, green snakes with large scales on top of the head and a pupil of the eye that is round in daylight are harmless. For example, the non-venomous snake *Orthriophis hodgsonii* (Fig. 4) is often confused with venomous pit vipers in the hills of Nepal.



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Fig. 4. Juvenile specimen of *Orthriophis hodgsonii* from central Nepal. Note the few very large scales on top of the head and the round pupil that distinguish this non-venomous species from pit vipers with similar colour pattern.

2. Green snakes whose pupil of the eye is horizontal and whose snout is very long and pointed (see Fig. 5) are only mildly venomous. The head of these snakes is also very long and thin, not very distinct from the

neck, and covered on top by large scales. When disturbed, these snakes (e.g., *Ahaetulla nasuta*) show their opened mouth to discourage their enemy.

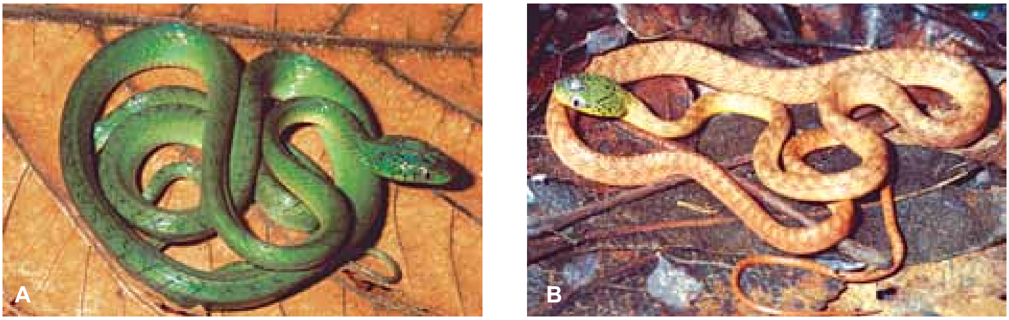

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Fig. 5. *Ahaetulla nasuta*. This mildly venomous species of "green snake" is easily distinguished from other snakes by its long pointed snout and horizontal pupil.

3. Green species of the genus of cat-eyed snakes (*Boiga* spp.) are more similar to the dangerous green pit vipers because their pupils are vertical in daylight just like those of the pit vipers. However, green cat-eyed snakes like the *Boiga cyanea* on the photo below have no pit organ between nostril and eye (this is present in all pit vipers), and they have only a few large scales on top of the head (versus many small scales in the case of green pit vipers). Like *Ahaetulla nasuta*, *Boiga* species are mildly venomous, having enlarged teeth in the back of their mouth which they use to inject venom into their prey, but no cases of human envenoming from their bites have become known in Nepal.


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Fig. 6. The mildly venomous Green Cat-eyed Snake (*Boiga cyanea*) is similar to the dangerously venomous green pit vipers in having a pupil that is vertical in light, but differs from them in having very large scales on top of the head and lacking venom fangs in the front of the mouth.



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Fig. 7. (A) Adult female Green Cat-eyed Snake (*Boiga cyanea*) from Suratthani, Thailand. (B) Juvenile of the same species from Ban Na San, Suratthani, Thailand. Like several species of green snake, *B. cyanea* undergo a colour change as they grow.

4. Green pit vipers are the only group of dangerously venomous snakes with green colouration in Nepal. There are several different species of green pit vipers in Nepal, and some have particular distributions according to altitude or vegetation. Most of them are difficult to distinguish from each other even for zoologists, but they all differ from their non-venomous or mildly venomous lookalikes in having a pit organ between the eye and the nostril (indicated by the red arrow on Fig. 8),



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Fig. 8. Kramer's Green Pit Viper (*Trimeresurus septentrionalis*) from Nepal showing the location of the opening of the pit organ between the eye and the nostril (arrow), numerous small scales on top of the head, and the yellow eye with a pupil that is vertical in light. These features are characteristic for all "green pit vipers" in Nepal although the colour of the eye and the head can vary according to the species or sex of the snake.

numerous small scales on top of the head (see Fig. 9), including the front, a head that is flat, triangular or heart-shaped and very distinct from the neck, and a pupil that is vertical in light. In addition, like all vipers these snakes have a pair of very long hollow fangs in the front of their upper jaw that can be folded back when not in use and erected for biting, and which function like injection needles to inoculate venom into their prey and enemies (see Fig. 3).

Although bites by green pit vipers usually cause mild envenoming only if compared to kraits and cobras, and fatalities are rare, these snakes appear to cause a large proportion of all cases of snake bite envenoming in Nepal. Envenoming by green pit vipers is very painful and may be followed by complications especially in the case of children. Loss of body fluids into massively swollen extremities can lead to hypovolaemic shock and requires proper replacement; destruction of local tissue by the venom as well as non-clotting blood and bleeding may also occur. There is presently no specific antivenom to treat green pit viper bites in Nepal. There is no evidence that the polyvalent snake antivenoms from India have any effect on green pit viper venoms. A special green pit viper antivenom is produced in Thailand but whether it is effective against the venoms of the green pit viper species of Nepal still needs to be determined.



A. Gumprecht, specimen courtesy of Fuhlrott Museum

Fig. 9. Head of an adult White-lipped Pit Viper (*Trimeresurus* cf. *albolabris*) from southern Nepal, viewed from above. Note the numerous small scales covering the head.

Snakes with blotched colour pattern

In Nepal, two species of python may be confused with some venomous snakes: The Burmese Python (*Python bivittatus*; see Fig. 10) and the Indian Rock Python (*Python molurus*, see Fig. 11). Adult pythons are much longer (3 to over 7 m) than any of the vipers in Nepal, but smaller ones may look quite similar at first sight. Like pit vipers, pythons have visible heat-sensitive pit organs, but in the case of these pythons they are located on the snout tip and the first two upper lip scales, actually below the nostril, not between the eye and the nostril as in pit vipers. Also, the



F. Tillack

Fig. 10. Burmese Python (*Python bivittatus*). The position of the heat sensitive pit organs of the python is indicated by the large red circles, that of the nostril by the small red circle.

pythons have smooth and shiny scales on their body (Russell's Viper and pit vipers have keeled scales) and few large scales on top of the head (small and numerous in Russell's Viper and all pit vipers in Nepal except *Gloydius himalayanus*). Finally, the colour pattern of pythons and Russell's Viper is different: The pythons have asymmetrical dark brown blotches that are often bordered with black, but Russell's Viper has symmetrical blotches that are round or oval in shape and with pointed ends. Pythons have no venom but kill their prey by constriction. If annoyed, they can deliver painful bites. Bites by large pythons can produce wounds that are similar to superficial cuts by a knife and may require surgical treatment.



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Fig. 11. Indian Rock Python (*Python molurus*).

Russell's Viper (*Daboia russelii*, Fig. 12 and 13) is the only species of "true" viper (a viper without pit organ) that is known from Nepal. Wherever it occurs, Russell's Viper is one of the most dangerous venomous snakes. In Nepal, it has so far been found in a few southern Terai districts only. Its head is



A. Captain/S. Thakur

Fig. 12. Juvenile Russell's Viper (*Daboia russelii*) from Maharashtra, India.



D. A. Warrell

Fig. 13. Adult Russell's Viper (*Daboia russelii*) from India, photographed at Madras Snake Park.

covered by numerous small scales. Its colour pattern with symmetrical, round or oval to leaf-shaped blotches on the body also distinguishes it from pythons and pit vipers, and from the sand boa. Note also the much longer tail of Russell's Viper (Fig. 13) if compared to that of the sand boa (Fig. 14).

The Common Sand Boa (*Gongylophis conicus*, Fig. 14 and 15) is a small non-venomous snake that is often confused with vipers. Snake charmers often use these harmless snakes in their shows pretending that they are dangerous vipers. In fact, like Russell's Viper, sand boas have numerous small scales on top of the head and a pupil that is vertical in light. However, the neck of sand boas is much thicker (in vipers the head is very distinct from the slender neck), sand boas have a very short tail, much shorter and more strongly keeled body scales, and a different, irregular pattern of dark blotches on the back. Sand boas usually grow up to 50-60 cm, rarely up to 1 m.



U. Kuch

Fig. 14. Common Sand Boa (*Gongylophis conicus*).



U. Kuch

Fig. 15. Common Sand Boa (*Gongylophis conicus)*, detailed view of the head and neck.



K.B. Shah

Fig. 16. John's Sand Boa (*Eryx johnii*).

Other snakes that look like vipers

In Nepal there are several species of snake that have a very similar appearance to the highly venomous pit vipers and Russell's Viper. Some of them have enlarged teeth in the front or back of their mouth and some are mildly venomous, but no cases of human envenoming have been reported. In contrast, pit vipers and Russell's Viper have very long venom fangs in the front of their mouth which can be erected for biting and folded back when the mouth is closed.

None of these non-venomous viper lookalikes has a pit organ between eye and nostril. This distinguishes them from all the pit vipers. The pit organ of the latter (see Fig. 8 and 19) is used for thermoreception, especially to detect warm-blooded prey or enemies in the environment, even in total darkness. A very species-rich group of vipers, known to zoologists as the subfamily Crotalinae, is called pit vipers because of this organ. All known vipers in Nepal except Russell's Viper are pit vipers. Most of the pit vipers give birth to fully developed young, but some like *Ovophis monticola* (see Fig. 92) lay eggs which the mother will guard.



F. Tillack

Fig. 17. Mock Viper (*Psammodynastes pulverulentus*), adult female from Cameron Highlands, Pahang State, West Malaysia, 1646 m above sea level. This non-venomous snake has rather large teeth in the upper and lower parts of the front of its mouth which it uses to grasp hard-bodied lizard prey.



F. Tillack

Fig. 18. Common Cat Snake (*Boiga trigonata*). This mildly venomous species has enlarged teeth in the back of its mouth.



F. Tillack

Fig. 19. Head of a Mountain Pit Viper (*Ovophis monticola*) in side view. The small red circle marks the position of the nostril, the large red circle that of the pit organ, halfway between nostril and eye.

The Himalayan Pit Viper (*Gloydius himalayanus*, see Fig. 20) is the only viper in Nepal that has few very large scales on top of the head like some of the non-venomous or mildly venomous lookalikes of vipers. However, it is distinguished from all of these by having a pit organ, and from most also by its distinct dark stripe that runs from the eye to the corner of the mouth.

The Mock Viper (*Psammodynastes pulverulentus*; see Fig. 17) and the Common Cat Snake (*Boiga trigonata*; see Fig. 18) look very similar to some vipers and pit vipers as far as their colour pattern, eyes and head shape are concerned. However, the top of their heads is covered with few very large scales. This distinguishes them from Russell's Viper and from almost all pit vipers in Nepal, which have numerous small scales on top of the head. One exception is the Himalayan Pit Viper (*Gloydius himalayanus*, see Fig. 20).



F. Tillack

Fig. 20. Himalayan Pit Viper (*Gloydius himalayanus*), adult male from Kalopani, Mustang, Dhaulagiri, Nepal, 2500 m above sea level.

Rat snakes and racers

There are several species of large, slender and fast-moving non-venomous or mildly venomous snake in Nepal that are active by day, or around dusk and dawn, and therefore often seen by people around their houses, in the fields, or in the forests. Some of these are often confused with the highly venomous cobras because they have a similar size and built, and because they are ready to defend themselves by biting if they see no chance to flee.


U. Kuch

Fig. 21. Head of an Indian Rat Snake (*Ptyas mucosa*).


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Fig. 22. Head of a Spectacled Cobra (*Naja naja*).

Although some of them can produce very impressive hissing and growling sounds, their defensive display is actually very different from that of cobras. For example, cobras will spread the skin of their neck horizontally, displaying dark round 'V' or 'Y' or 'O' shaped marks on their neck, and will usually raise their forebody vertically off the ground, looking at their adversary (see Fig. 23). Rat snakes and racers, on the other hand, inflate their neck and forebody by inhaling air and extending their body in vertical direction (see Fig. 24). They also stay closer to the ground, bringing their forebody into S-shaped positions that will facilitate striking or darting off in an attempt to escape. Compared to cobras they also have more slender and much longer heads and much larger eyes.

All of these snakes are very useful especially for farmers because they help to control populations of mice and rats. Some species of rat snake and racer kill their prey by constriction, others simply by pressing it onto the ground. Some have been found to produce certain toxins in their oral glands, but there has been no report of envenoming from any of the rat snake and racer species that occur in Nepal. However,



U. Kuch

Fig. 23. Spectacled Cobra (*Naja naja*) viewed from above, showing its typical defensive display that includes a raised forebody, neck skin spread to a "hood" with spectacle-shaped marks.



F. Tillack

Fig. 24. Copper-headed Trinket Snake (*Coelognathus radiatus*)



F. Tillack

Fig. 25. Indian Rat Snake (*Ptyas mucosa*).

when they feel cornered most will defend themselves by biting. As these are large snakes that usually reach 1.5-2.5 m, sometimes even over 3 m, they can inflict painful and bleeding (but harmless) wounds which should be treated like any other scratch wound.



F. Tillack

Fig. 26. Indo-Chinese Rat Snake (*Ptyas korros*), subadult specimen from Suratthani, Nakhon Si Thammarat, Thailand.

Water snakes

Water snakes that are common in and around rice/paddy fields and ponds are very often seen by people and sometimes confused with venomous snakes. The Striped Keelback (*Amphiesma stolatum*; see Fig. 27 and 28) is active by day and rarely bites. It is easily recognized by its pattern of blotches on the anterior body and distinct stripes on the posterior body and tail.


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Fig. 27. Striped Keelback (*Amphiesma stolatum*).


F. Tillack

Fig. 28. Striped Keelback (*Amphiesma stolatum*) from Naudanda-Kaidala, Kaski, Gandaki, Nepal, 1300 m above sea level.

The Checkered Keelback group (*Xenochrophis piscator* and closely related species, see Fig. 29) comprises larger snakes that can grow to more than 1 m, are often very active at sunset or night, and will defend themselves readily by biting when they are caught or stepped on. They are often mistaken for cobras. As they are very common, they cause a large proportion of non-envenoming snake bites in Nepal.


U. Kuch

Fig. 29. Two Checkered Keelbacks (*Xenochrophis piscator* complex) from Bangladesh.

Siebold's Water Snake (*Ferania sieboldii*, see Fig. 30) is sometimes confused with vipers or pit vipers, but in the areas where it lives, all of these have small scales on top of the head (vs. large scales in *Ferania*). For its dark and light pattern on the back it might also be mistaken for a krait, but in *Ferania* all scales on the back are of similar size (those of the middle row are much enlarged in kraits), and *Ferania sieboldii* has many more rows of scales around the body than kraits (27-33, vs. 15-17 in most kraits).



F. Tillack

Fig. 30. Siebold's Water Snake (*Ferania sieboldii*).

Wolf and Kukri snakes

Looking similar to the highly dangerous kraits, the Common Wolf Snake (*Lycodon aulicus*, see Fig. 31 and 32) belongs to those snakes that most commonly enter human houses or even live there permanently. These small snakes usually reach 40-80 cm and eat other small animals like skinks, geckos and mice. As they are also active at night, have a somewhat similar colour pattern and are usually quick to bite if they are touched or handled, they are often confused with kraits like the Common Krait (*Bungarus caeruleus*). However, the bites of Common Wolf Snakes are harmless, so this species contributes a great part of those snake bites that do not result in envenoming. In marked difference to kraits, the scales on the back of wolf snakes are all of similar size and shape.



U. Kuch

Fig. 31. Common Wolf Snake (*Lycodon aulicus*), adult female caught in a shop in the centre of Damak, Jhapa, Nepal.



F. Tillack

Fig. 32. Common Wolf Snake (*Lycodon aulicus*), adult female from Naudanda, Kaski, Gandaki, Nepal, 1450 m above sea level.

Another group of small snakes that are occasionally confused with kraits or vipers are Kukri snakes (*Oligodon arnensis*; see Fig. 33). Their English common name refers to the fact that they have very large, blade-like teeth in their mouth. With these they can inflict painful bites. As there have been reports in other countries about prolonged bleeding from such bite wounds, caution is indicated. Kukri snakes differ from Russell's Viper and pit vipers in having a pupil that is round in light, and large scales on top of the head; from pit vipers also because they have no pit organ. They differ from kraits in having scales on the back that are all of similar size and shape. One species, *Oligodon albocinctus*, may be confused with MacClelland's Coral Snake (*Sinomicrurus macclellandi*) due to their similar colour pattern, however, the eye of the venomous coral snake is almost completely black while that of the Kukri snake has a light ring around the pupil.



U. Kuch

Fig. 33. Kukri Snake (*Oligodon arnensis*) from the campus of B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

Uniformly black and brown snakes

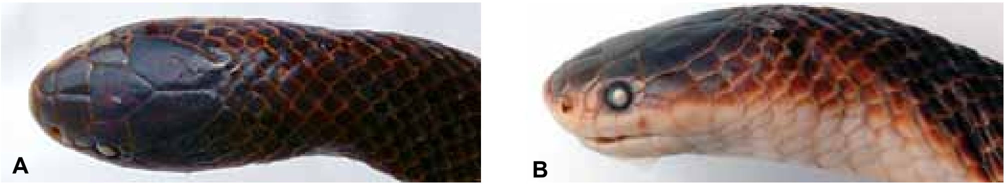
In Nepal, there is a number of species of smaller snakes that have a uniformly black or brown colouration on the back side of their bodies (often with lighter bellies) and that are not cobras or rat snakes. Many of these are non-venomous or only mildly venomous and not dangerous to humans, but some are highly dangerous venomous snakes so it is important to recognize them.

There are two different species of deadly venomous black krait found in Nepal, the Greater Black Krait (*Bungarus niger*, see Fig. 34) and the Lesser Black Krait (*Bungarus lividus*, see Fig. 35). Like all kraits, they differ from most snakes in Nepal in having one row of hexagonal scales along the middle of their back from neck to tail (on top of the vertebral column, therefore also called vertebral scales) that are much larger than the other scales on the back of their body.



F. Tillack

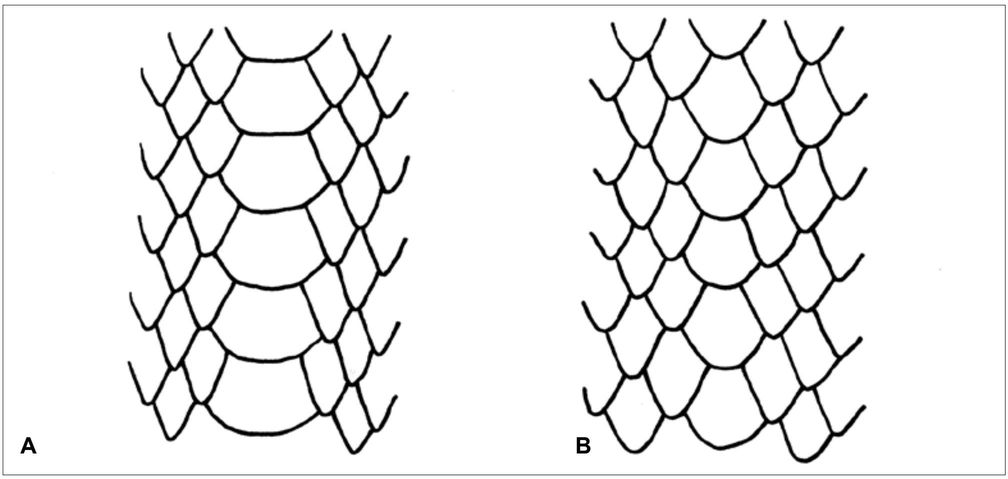
Fig. 34. Greater Black Krait (*Bungarus niger*). Note that the scales along the back of the body (vertebral scales) are much larger than the adjacent body scales. This is typical of all kraits except *Bungarus lividus*, which has smaller vertebral scales. Like all kraits, these species are highly venomous.



U. Kuch

Fig. 35. (A and B) Head of a Lesser Black Krait (*Bungarus lividus*) in close-up view. Note the small eye, pointed snout and head that is not distinct from the neck. The pupil of the eye is white because the snake is a preserved museum specimen; in live snakes the eye appears like a small jet black bead.

The black krait species *Bungarus niger* and *Bungarus lividus* differ in the size of these enlarged scales. In *Bungarus niger*, they are very large, like in all other species of krait. In *Bungarus lividus*, they are only slightly larger than the bordering scales on the back of the body.



Drawing modified from F. Wall (1908)

Fig. 36. Strongly enlarged vertebral scales on the back of *Bungarus niger* (and other kraits, A) and only slightly enlarged vertebral scales of *Bungarus lividus* (B).

Some cat snakes in Nepal (e.g., *Boiga ochracea*, see Fig. 37) can have a similar uniformly brown colouration and also have an enlarged row of scales along the middle of their back. However, they can be distinguished from kraits in having much larger eyes and a pupil that is easily visible and of vertical shape in light. The eyes of black kraits are very small and appear black in life. Cat snakes also differ from all kraits in Nepal except *Bungarus bungaroides* in having paired (divided) scales on the lower side of the tail, and in having a comparatively bigger head that is distinct from the slender neck. In addition, cat snakes differ from kraits in having a body that appears laterally compressed (vs. round or triangular in cross-section as in kraits).

Cat snakes are rear-fanged snakes that use enlarged teeth in the back of their mouth to apply venom to their prey. The cat snake species in Nepal are considered to be mildly venomous, and no cases of human envenoming by them have been reported.

The Tawny Cat Snake (*Boiga ochracea*) is widely distributed in the lowlands and hills of Nepal and neighbouring countries. It is often reddish-brown, yellowish-brown or even coral red, but darker specimens may be confused with black kraits. Like kraits, it is active at night, but unlike kraits it mostly climbs in house walls, bushes or shrubs where it preys on lizards, birds and small mammals. Note the large eye with well visible vertical pupil.



F. Tillack

Fig. 37. Tawny Cat-eyed Snake (*Boiga ochracea*), subadult female from Naudanda-Serachaur, Kaski, Gandaki, Nepal, 1300 m above sea level.

How many snake species occur in Nepal, and how many of these are dangerous?

So, far 89 species of snake have been recorded from Nepal, but the exact number remains to be determined because large parts of the country are still unexplored from a biological point of view, and some published records of snake species that are difficult to identify require further study and verification. Among this great diversity of snakes, we know with certainty of 17 species of snake that occur in Nepal and have the front-fanged type of venom apparatus and thus are considered to be highly venomous and dangerous.

These snakes can be subdivided further into two groups:

Kraits, cobras, king cobras and coral snakes (family Elapidae)



U. Kuch

Fig. 38. Spectacled Cobra (*Naja naja*) from Damak, Nepal.

Snakes of this group have two relatively short fangs that are firmly attached and immobile, one on each side of the upper front of their mouth (on the maxillary bone). Although short, their teeth have deep grooves on the outside that efficiently serve as canals to transport venom into the prey or enemy. Some of these snakes, especially kraits, have very small fangs. Their bites often do not result in visible bite marks or bleeding wounds. However, this does not help to predict the severity of envenoming. In a krait bite, even if there is no visible bite mark and no health problem at all during the first few hours, it is still possible that life-threatening envenoming like respiratory paralysis may develop after up to 12 hours. Thus, all (suspected) snake bites should be observed in hospital for 24 hours even if there are no signs of illness at the beginning.

Bungarus bungaroides

Himalayan Krait (English), Pahadi Karet, Himali Karet (Nepali)

Identification: Usually 1-1.5 m long, hatchlings about 30 cm. Shiny black, brownish black or grey body and tail with very narrow white or yellowish rings. Light rings often much obscured in large adults, less than one scale wide on body but extending completely across belly where they are broader. Tail tip pointed. Fifteen rows of scales across back, scales along vertebral ridge much larger than bordering scales. Scales on lower side of tail divided.



S. Dalvi

Fig. 39. Himalayan Krait (*Bungarus bungaroides*) from Eagle Nest, Arunachal Pradesh, India. Note the light lines on the head which are typical of young individuals of this species.

Distribution and habitat: Likely throughout the lowlands and lower mountains of eastern Nepal. Elsewhere, from the Brahmaputra Valley of Tibet, Bhutan and north-eastern India to northern Myanmar. Known from open forests, agricultural lands and residential areas between 200 and 1500 m altitude.

Medical importance and behaviour: Very little is known about this rarely encountered snake. Surprisingly for kraits, there have been a couple of observations of this species that suggested activity during the day. There have been no identified bites by this species which is likely often confused with *Bungarus caeruleus*. It should be expected that envenoming by this species can cause death in a short time.

Venom effects: In the absence of studies on the venom of *B. bungaroides* it should be expected that it is similar to other krait venoms in causing progressive paralysis of the peripheral nervous system, leading to respiratory paralysis and death due to asphyxia, and possibly systemic muscle damage with myoglobinuria, acute renal failure and hyperkalaemia. Thus, both neurotoxic and myotoxic envenoming and their complications should be anticipated when treating a patient bitten by this snake.


S. Dalvi

Fig. 40. Lower side of tail of the Himalayan Krait (*Bungarus bungaroides*) showing light rings and divided subcaudal scales.


V. K. Mistry

Fig. 41. Large adult Himalayan Krait (*Bungarus bungaroides*) from Eagle's Nest, Arunachal Pradesh, India with uniformly dark grey to black anterior body.


V. K. Mistry

Fig. 42. Enlarged row of scales along vertebral ridge and light rings across posterior body of the same snake as in Fig. 41.



S. Dalvi

Fig. 43. Large adult Himalayan Krait (*Bungarus bungaroides*; same snake as in Fig. 41); note light rings across body.



S. Dalvi

Fig. 44. Large adult Himalayan Krait (*Bungarus bungaroides*; same snake as in Fig. 41); note light rings across the dark belly.

Bungarus caeruleus

Common Krait (English), Seto-kalo Chure Sarpa, Gadaich, Chure Sarpa (Nepali)

Identification: Usually 0.8-1.2 m (up to 1.75 m) long, hatchlings about 25 cm. Very narrow white bands on back of shiny black to dark brown body and tail (often absent from anterior body). Belly uniformly light. Tail tip pointed. Fifteen rows of scales across back, scales along vertebral ridge much larger than bordering scales. Scales on lower side of tail undivided.



U. Kuch

Fig. 45. Adult Common Krait (*Bungarus caeruleus*) from near Rangpur, north-western Bangladesh.

Distribution and habitat: Likely throughout the lowlands and lower mountains of Nepal, known from <100-1525 m. Also eastern Afghanistan, Pakistan, India, Sri Lanka, Bangladesh. Prefers forests, grasslands, agricultural lands and residential areas; hides in houses, rodent burrows, crevices, piles of bricks, rocks, rubble or woods.

Medical importance and behaviour: One of the most common and most dangerous causes of snake bite envenoming in Nepal. Feeds on snakes, rodents and other small animals. Active at night. Climbs and swims well. Typically bites sleeping people inside their homes. Envenoming by this species can cause death in a short time, but often several hours elapse between bite and onset of paralysis. In most fatal cases death occurred within 12-24 hours.

Venom effects: *Bungarus caeruleus* venom causes abdominal pain and progressive paralysis of the peripheral nervous system, leading to respiratory paralysis and death due to asphyxia. Early signs include abdominal pain, headache, convulsions; paralysis usually starts with the eyelids and other muscles of the face. Early assisted ventilation and airway management are crucial and life-saving.



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Fig. 46. Adult Common Krait (*Bungarus caeruleus*) from near Rangpur, north-western Bangladesh, showing reduction of light bands on anterior body.



U. Kuch

Fig. 47. Juvenile Common Krait (*Bungarus caeruleus*) from Pakistan, protecting itself by coiling up and hiding its head under the body.



D. A. Warrell

Fig. 48. Common Krait (*Bungarus caeruleus*) from Pune, India. Top left part of the body dilated after ingestion of a prey item.

Bungarus fasciatus

Banded Krait (English), Gangawari, Panhelo-kalo Chure Sarpa, Kanthamala, Laxmi Sanp, Raja Sanp, Maher, Gwala Sarpa, Ahiriniya Sanp (Nepali)

Identification: Usually 1-2 m (up to 2.25 m) long, hatchlings about 30-35 cm. Broad black and light rings of similar width on body and tail. Light rings yellow in adults, cream to white in juveniles, extending completely across belly. Tail tip blunt, not pointed, sometimes mistaken for a second head. Body triangular, vertebral column forming distinct ridge along top of the back. Fifteen rows of scales across back, scales along vertebral ridge much larger than bordering scales. Scales on lower side of tail undivided.



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Fig. 49. Banded Krait (*Bungarus fasciatus*) from Damak, Jhapa, Nepal, trying to hide its head under a leave as part of its typical defensive behaviour. During the day, these snakes are inactive and very reluctant to bite.

Distribution and habitat: Likely throughout the lowlands and lower mountains of Nepal. Elsewhere, from India east to China and south to Indonesia. Known from coastal and mangrove swamps at sea level to mountain forests at 2300 m altitude (in Myanmar). Prefers wet habitats and vicinity of water (e.g., ponds, streams, rice fields, near villages).

Medical importance and behaviour: Common snake, active at night, often seen by people. Its favourite food are snakes including venomous ones. Usually hides head under body if disturbed, hissing and making jerking movements. Bites appear to be rare in Nepal but envenoming by this species is very dangerous and can result in death in a short time.

Venom effects: The major dangerous effect of *B. fasciatus* venom is progressive paralysis of the peripheral nervous system, leading to respiratory paralysis and death due to asphyxia. Systemic muscle damage with myoglobinuria, acute renal failure and hyperkalaemia has caused death in a case suspected to have been caused by this species in north-western Bangladesh. Thus, both neurotoxic and myotoxic envenoming and their complications should be anticipated.



W. Grossmann

Fig. 50. Juvenile Banded Kraits (*Bungarus fasciatus*) have a pattern of white to cream and black rings on the body. The white rings become yellow as the snakes grow.



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Fig. 51. Close-up view of the tail tip of a Banded Krait (*Bungarus fasciatus*). The tail tip of adults of this species is thicker and more rounded than in most other snakes.



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Fig. 52. Ventral side of a Banded Krait (*Bungarus fasciatus*). The light and black bands encircle the body completely, and they are of similar width.



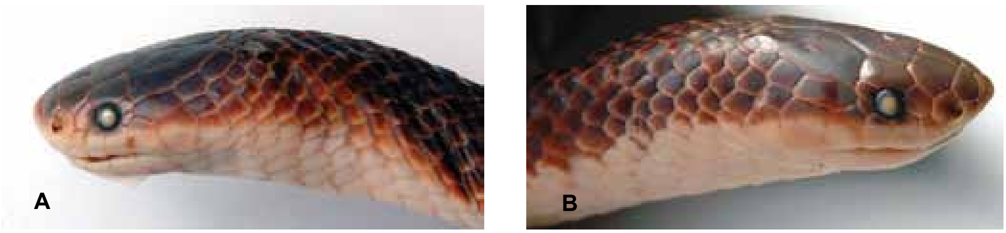
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Fig. 53. Adult Banded Krait (*Bungarus fasciatus*) displayed by a snake charmer in Bangladesh. Snake charmers often handle Banded Kraits very carelessly because they know that these snakes rarely bite at daytime. However, during the night when they are active, Banded Kraits readily defend themselves by biting.

Bungarus lividus

Lesser Black Krait (English), Sano Kalo Karet (Nepali)

Identification: Usually 60-90 cm long, rarely more than 1 m. Shiny black, brownish black or brown head, body and tail with no light bands or lines. Lower side of head and anterior body whitish, obscured by brown pigment on lower side of posterior body and tail. Tail tip pointed. Fifteen rows of scales across the back. Scales along vertebral ridge only slightly larger than the bordering scales or of normal size. Scales on lower side of tail undivided.



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Fig. 54. (A) Lesser Black Krait (*Bungarus lividus*). Preserved museum specimen from near Dinajpur, Bangladesh. In live snakes, the eye appears like a solid jet black bead and the pupil (white on the photo) is difficult to see. (B) Same specimen, showing the pointed snout that may be used for digging in loose soil or leaf litter, and the whitish lower side of the head and throat.

Distribution and habitat: Likely throughout the lowlands and lower mountains of Nepal; so far known from central and eastern parts. Elsewhere, north-eastern India and northern Bangladesh. Known from forests, grasslands, agricultural lands and residential areas below 250 m altitude.

Medical importance and behaviour: Very little is known about this rarely encountered snake. It is active at night and known to eat snakes and rodents and to come into houses at night. There have been few proven bites by this species which is likely often confused with *B. caeruleus.* Envenoming by this species has caused death within 24 hours and may be common in some areas.

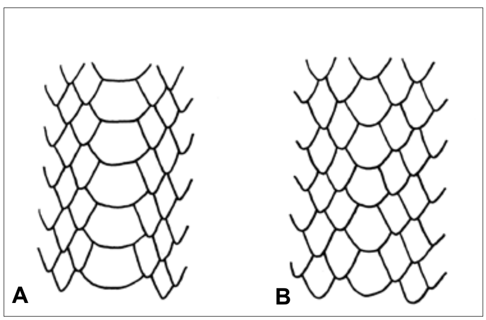


Fig. 55. Strongly enlarged vertebral scales on the back of *Bungarus niger* (and other kraits, A) and only slightly enlarged vertebral scales of *Bungarus lividus* (B). Drawing modified from F. Wall (1908)

Venom effects: The venom of *B. lividus* has not been studied yet. Envenoming by this species in Nepal has caused burning sensation at the bite site and over the whole body, abdominal pain, vomiting, slurred speech, ptosis, and progressive generalized neuromuscular paralysis leading to respiratory distress and death. Neurotoxic and possibly myotoxic envenoming and their complications should be anticipated when treating a patient bitten by this snake.



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Fig. 56. Adult male Lesser Black Krait (*Bungarus lividus*). This snake caused a fatal bite inside the Beldangi Refugee Camp of Jhapa District, Nepal, where it had hidden under a pillow in a bed. It was subsequently killed by neighbours.



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Fig. 57. Lesser Black Krait (*Bungarus lividus*). Ventral side of the same snake showing the light anterior part of the belly that is gradually obscured with dark pigment on the posterior body.

Bungarus niger

Greater Black Krait (English), Thulo Kalo Karet (Nepali)

Identification: Usually 70-90 cm long, rarely up to 1.3 m. Shiny black, brownish black or dark chocolate brown head, body and tail with no light bands or lines. Lower side of head and anterior body dirty white to yellow, obscured by brown pigment on lower side of posterior body and tail. Tail tip pointed. Fifteen rows of scales across the back, scales along vertebral ridge much larger than the bordering scales. Scales on lower side of tail undivided.



F. Tillack

Fig. 58. Greater Black Krait (*Bungarus niger*) viewed from above. Note the greatly enlarged row of scales running along the middle of the back, the key feature to distinguish this species from the other black krait in Nepal, *Bungarus lividus*.

Distribution and habitat: Lowlands and lower mountains probably throughout Nepal, but so far recorded only from Kaski District at 1450 m altitude. Elsewhere, found from mangrove swamps at sea level to mountain forests, agricultural lands and residential areas from north-western India (Uttarakhand) to Bhutan, north-eastern India, Bangladesh and western Myanmar.

Medical importance and behaviour: The fact that *B. niger* is a medically important snake was only discovered in recent years. It is active at night and known to come into houses or become entangled in fishing nets, and to eat rodents and snakes. Bites by this species have often been confused with *B. caeruleus* bites. They can cause death within 24 hours.

Venom effects: The venom of *B. niger* causes progressive paralysis of the peripheral nervous system, leading to respiratory paralysis and death due to asphyxia, and it causes systemic muscle damage with myoglobinuria, acute renal failure and hyperkalaemia. Thus, the complications of both neurotoxic and myotoxic envenoming must be anticipated in patients bitten by such a snake. Assisted ventilation is crucial and dialysis may be needed, too.



F. Tillack

Fig. 59. Greater Black Krait (*Bungarus niger*) from Naudanda, Kaski, Gandaki, Nepal, 1450 m altitude. Detailed view of the head of the same snake. Note the very small eye that appears jet black without visible pupil.

Bungarus walli

Wall's Krait (English), Bairi Karet, Gadaich (Nepali)

Identification: Usually 1-1.3 m long (up to 1.65 m), hatchlings about 25-30 cm. Shiny black, brownish black or grey head, body and tail with numerous very narrow white or yellowish bands. Light bands often much obscured on anterior body and less than one scale wide. Belly uniformly white. Tail tip pointed. Seventeen (rarely 19 or 21) rows of scales across the back; scales along vertebral ridge much larger than the bordering scales. Scales on lower side of tail undivided.


M.A.W. Chowdhury

Fig. 60. Wall's Krait (*Bungarus walli*), specimen from Lakshmipur District, Bangladesh.

Distribution and habitat: Likely throughout the lowlands of Nepal but so far known from the southeast only. Elsewhere, from the Gangetic floodplains of northern India to the delta region of Bangladesh. Known from grasslands, open forests, agricultural lands and residential areas.

Medical importance and behaviour: *Bungarus walli* was only recently identified as a medically important snake because it had usually been mistaken for *B. caeruleus*. In certain areas both species occur but in others one of the two is the leading cause of krait bite envenoming. Envenoming

by *B. walli* appears to be common in south-eastern Nepal. Active at night; known to feed on rodents, snakes and frogs. Highly dangerous; apparently more irritable than *B. caeruleus*.

Venom effects: The venom of *B. walli* has not been studied so far. Envenoming by this species has caused a clinical syndrome similar to that of *B. caeruleus* envenoming. In addition to progressive paralysis of the peripheral nervous system leading to respiratory paralysis, however, individual patients also had convulsions, cardiac complications and variable degrees of haemo/myoglobinuria.



M.A.W. Chowdhury

Fig. 61. (A) Wall's Krait (*Bungarus walli*) from Lakshmipur, southern Bangladesh, showing details of the head pattern. In Common Kraits (*Bungarus caeruleus*) the distinction between the dark and light areas on the head is often less clear. (B) Same specimen showing details of the narrow white bands and greatly enlarged row of scales along the middle of the back.



U. Kuch

Fig. 62. Wall's Krait (*Bungarus walli*, A) and Common Krait (*Bungarus caeruleus*, B). Although the two species look similar, they can be reliably distinguished by the number of scale rows across their back: *Bungarus caeruleus* has only 15, but *Bungarus walli* 17 (rarely 19-21).

Naja naja

Common Cobra, Spectacled Cobra (English), Goman, Nag (Nepali)



U. Kuch

Fig. 63. Spectacled Cobra (*Naja naja*) showing its defensive display with vertically raised anterior body and spread "hood".

Identification: Usually 1.5-1.6 m (up to 2.2 m) long, hatchlings about 25-30 cm. Light brown, tan to black ground colour with spectacle-shaped mark on neck, two black spots on lower side of throat and 2 or 3 broad black cross-bars on the belly behind the hood. Twenty-one to 25 rows of scales across back at midbody; scales along vertebral ridge of same size as bordering scales. Tail tip pointed; scales on lower side of tail divided.

Distribution and habitat: Likely throughout the lowlands and lower mountains of Nepal up to at least 1600 m altitude. Elsewhere, Pakistan, India, Sri Lanka, Bhutan, Bangladesh; in forests, grasslands, agricultural lands, and residential areas.

Medical importance and behaviour: One of the most common and most dangerous causes of snake bite envenoming in Nepal. Active by day and night, especially at dawn and dusk. Feeds mainly on rodents, frogs, birds; swims well. Raises forebody, displays extended neck skin "hood" and hisses when disturbed.

Venom effects: Envenoming by *N. naja* causes local swelling of the bitten part and in a large number of cases also progressive paralysis of the peripheral nervous system, leading to respiratory paralysis and death due to asphyxia. Neurotoxic features of *N. naja* envenoming are typically reversible by antivenom and anticholinesterase treatment. Local envenoming may result in tissue necrosis and contractures requiring surgical intervention.



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Fig. 64. Spectacled Cobra (*Naja naja*) showing its defensive display with "spectacle-shaped" marks on the back of its neck skin while trying to escape.



U. Kuch

Fig. 65. Spectacled Cobra (*Naja naja)* from Damak, Jhapa District, Nepal. The ground colour of cobras is quite variable and may range from light brown to almost black. The specimen on this photo appears especially dark because it will soon shed the old upper layer of its skin.

Naja kaouthia

Monocellate Cobra, Monocled Cobra (English), Goman, Paniyadarad (Nepali)

Identification: Usually 1.5-1.6 m (up to 2.3 m) long, hatchlings about 25-35 cm. Light brown, tan to black ground colour with monocellate (O-shaped) mark on neck, two black spots on lower side of throat and 2 or 3 broad black cross-bars on the belly behind the hood. Twenty-one (sometimes 19-23) rows of scales across the back at midbody; scales along vertebral ridge of same size as bordering scales. Tail tip pointed; scales on lower side of tail divided.



K.B. Shah

Fig. 66. Monocellate Cobra (*Naja kaouthia*) from Bara District, Nepal.

Distribution and habitat: Likely throughout the lowlands and lower mountains of central and eastern Nepal up to at least 3200 m. Elsewhere, Bhutan, north-eastern India, Bangladesh and Myanmar to China, Vietnam and north-western Malaysia. Prefers forests, grasslands, agricultural lands and residential areas close to water.

Medical importance and behaviour: Bites by this species appear to be less common than those by *N. naja* in Nepal although in most cases of cobra bite the species involved is not identified. Active by day and night, especially at dawn and dusk. Feeds mainly on frogs, toads, fish and rodents; swims well. Raises forebody, displays extended neck skin "hood" and hisses when disturbed.

Venom effects: Envenoming by *N. kaouthia* causes local swelling of the bitten part and in a large number of cases also progressive paralysis of the peripheral nervous system, leading to respiratory paralysis and death due to asphyxia. Neurotoxic features of *N. kaouthia* envenoming are typically reversible by antivenom and anticholinesterase treatment. Local envenoming may result in tissue necrosis and contractures requiring surgical intervention.



U. Kuch

Fig. 67. Monocellate Cobra (*Naja kaouthia*) in a snake charmer's collection in Bangladesh.



U. Kuch

Fig. 68. Monocellate Cobra (*Naja kaouthia*) showing the characteristic neck mark in defensive display.

Ophiophagus hannah

King Cobra (English), Raj Goman, Kalinag, Kenwata (Nepali)

Identification: Usually 3-3.5 m (up to 5.5 m) long, hatchlings about 40-60 cm. It is the largest venomous snake in the world. Shiny black to brown, grey or tan ground colour. Juveniles with distinct narrow white or yellowish bands on body and tail, faded and indistinct in most adults. Back of the neck without spectacle-shaped or monocle-shaped spots. A pair of large occipital shields in contact with one another on top of the head. Tail tip pointed. Fifteen rows of scales across back at midbody, scales along vertebral ridge not larger than bordering scales. Scales on lower side of tail undivided anteriorly and divided posteriorly.

Distribution and habitat: Likely throughout the lowlands and lower mountains of Nepal up to 3500 m altitude. Also India, Bangladesh, Bhutan and Southeast Asia. Prefers forests and plantations in the vicinity of water and bamboo stands; rarely seen in disturbed agricultural lands.

Medical importance and behaviour: King cobras are active by day, move rapidly, climb and swim well. They mainly feed on snakes including pythons, sometime also on other reptiles like monitor lizards. When cornered they raise their anterior body and emit a deep growling sound. Bites appear to be rare in Nepal.

Venom effects: Envenoming by *O. hannah* causes local swelling of the bitten part and progressive paralysis of the peripheral nervous system, leading to respiratory paralysis and death due to asphyxia. As king cobras can inject huge amounts of a venom that is not included in the production of Indian polyvalent antivenoms, large amounts of antivenom may be needed for neutralization. Local envenoming may result in necrosis requiring surgical intervention.



K.B. Shah

Fig. 69. King Cobra (*O. hannah*) from Kathmandu, Nepal.



A. Captain/Indian Herp. Society

Fig. 70. King Cobra (*Ophiophagus hannah*) from Orissa, India.

Sinomicrurus macclellandi univirgatus

MacClelland´s Coral Snake (English), Mugasanp, Karkat Nag (Nepali)

Identification: Usually 50-80 cm long. Head black above with a wide white, yellow or cream coloured transverse stripe behind the eyes. Back of the body reddish brown with or without a black vertebral stripe or remains of incomplete thin black transverse bands on the flanks; below yellowish with black bars or quadrangular spots. Thirteen rows of scales across the back; scales along vertebral ridge not larger than bordering scales. Tail short with pointed tip. Scales on lower side of tail divided (rarely some undivided).



A. Captain/The Lisus

Fig. 71. MacClelland's Coral Snake (*Sinomicrurus macclellandi*). Adult specimen from Arunachal Pradesh, India.

Distribution and habitat: Lowlands and lower mountains from western, central to eastern Nepal up to at least 2200 m. Also reported from north-eastern India (Sikkim). Known from forests, scrublands and agricultural lands.

Medical importance and behaviour: Very little is known about this rare snake. It appears to be active at night, dawn and dusk, digs well in loose soils and is reported to feed on earthworms, snakes and beetles. If cornered, it responds by flattening its body and lifting and curling its tail. Bites appear to be very rare in Nepal but one fatal case was reported.

Venom effects: The venom of this species has not been studied so far. The available information suggests that it causes severe neurotoxic envenoming leading to respiratory paralysis. However, as several other coral snake venoms are known to also have myotoxic activities, both neurotoxic and myotoxic envenoming and their complications should be anticipated when treating a patient bitten by this snake.


A. Captain/The Lisus

Fig. 72. MacClelland's Coral Snake (*Sinomicrurus macclellandi*) from Arunachal Pradesh, India. Note the broad white cross-band behind the eyes.


K.B. Shah

Fig. 73. MacClelland's Coral Snake (*Sinomicrurus macclellandi univirgatus*) from Ilam District, Nepal.



H.H. Schleich

Fig. 74. MacClelland's Coral Snake (*Sinomicrurus macclellandi univirgatus*) from the Kathmandu Valley, Nepal. The snake uses its raised and flattened tail in defense to distract the enemy's attention from its head.



H.H. Schleich

Fig. 75. MacClelland's Coral Snake (*Sinomicrurus macclellandi univirgatus*) from the Kathmandu Valley, Nepal. In this subspecies the black pattern on the back is reduced to a stripe or series of spots along the back.

Vipers and pit vipers (family Viperidae)

This group comprising species like Russell's Viper, the Mountain Pit Viper, and all green pit vipers is characterized by having two very long fangs that are also attached to the upper front of the jaw in the mouth but are mobile and can be folded back when not in use. These fangs are erected only when the snake opens its mouth and attempts to bite (see Fig. 3). This option of folding back the fangs has allowed this group of snakes to penetrate fur, feathers, or thick skin of the prey - and clothes or certain shoes of human snake bite victims. In the processes of evolution, these long fangs have reached a level of perfection that is superior to that of any other snake tooth: They are hollow like a medical injection needle, and they work just like this.

The venom of these snakes is very different from that of cobras, king cobras, kraits and coral snakes. One particular feature of the venom of vipers and pit vipers is that it causes pain very soon after the bite – much more pain than the bite itself. However, the degree of pain caused by these venoms is not predictive of the real medical complications they cause. In fact, many cases especially of pit viper bites only result in painful local swelling without serious complications, and this swelling usually subsides after a few days. In some cases, there will be more serious venom effects like changes in blood coagulation abilities, bleeding from body parts other than the bite site, local destruction of tissues or kidney problems. This is why all of these bite accidents should be observed in hospital so that complications can be prevented or treated immediately.



F. Tillack

Fig. 76. Kramer's Pit Viper (*Trimeresurus septentrionalis*), adult female from Pyaudi, Kaski, Gandaki, Nepal, 1050 m above sea level.

Daboia russelii

Russell's Viper (English), Baghesarpa, Suskar (Nepali)

Identification: Usually 0.9-1.5 m (up to 1.8 m) long, hatchlings about 24 cm. Light brown ground colour with three longitudinal series of large rounded or oval spots on the body. The centre of each spot is usually brown bordered with black and yellow or white edges. Occasionally, these spots touch each other or fuse. Two large symmetrical dark brown marks on top of the head. Top of head covered by many small and strongly keeled scales. At midbody, 27-33 rows of scales across the back, all except outer rows strongly keeled. Scales on lower side of tail divided.



D. A. Warrell

Fig. 77. Russell's Viper (*Daboia russelii*), adult specimen from Pune, Maharashtra, India.

Distribution and habitat: In Nepal known from very few localities in the lowlands only (<100-250 m altitude). Also India, Pakistan, Bangladesh, Bhutan, Sri Lanka from sea level up to 2756 m. Prefers open grassy areas, scrublands, forest edges, agricultural lands (often rice fields) and residential areas.

Medical importance and behaviour: Elsewhere one of the medically most important highly dangerous snake species. No confirmed bites by Russell's Viper are known from Nepal yet. Ambush predator feeding on rodents, birds, lizards and frogs. Usually inactive at day but active at night, dawn and dusk; produces very loud and deep hissing sound when disturbed and vigorously strikes in defence.

Venom effects: Envenoming by *D. russelii* causes painful local swelling, non-clotting blood, internal and external bleeding and cardiovascular shock; in some areas additionally myotoxicity with myoglobinuria and renal failure or neurotoxicity with paralysis. Local envenoming may result in massive loss of body fluids into tissues, and in blistering and necrosis requiring surgical intervention.



D.A. Warrell

Fig. 78. Russell's Viper (*Daboia russelii*), adult specimen from Pune, Maharashtra, India.



A. Captain/S. Thakur/Indian Herp. Society

Fig. 79. Juvenile Russell's Viper (*Daboia russelii*) from Maharashtra, India.

Gloydius himalayanus

Himalayan Pit Viper (English), Bhyagute Sarpa (Nepali)



Fig. 80. Himalayan Pit Viper (*Gloydius himalayanus*), adult male from Kalopani, Mustang District, Nepal, 2500 m.

Identification: A small viper with pit organ between nostril and eye. Usually 40-60 cm (up to 86 cm) long; hatchlings about 16-20 cm. The large triangular head is very distinct from the neck. The top of the head is covered with large scales in the front and small scales in the back. A black stripe extends from the eye to the corner of the mouth. Body colour brown or grey with dark brown or blackish brown spots, zig-zag bands or horse-shoe shaped blotches; lower side of the body brown speckled with black and white. Body scales strongly keeled, arranged in 21 (rarely 23) rows at midbody. This species is also known as *Agkistrodon himalayanus* in the older literature.

Distribution and habitat: Hills and mountains of Nepal from 1640-3060 m altitude; also in north-western India, Pakistan (up to 4880 m) and possibly eastern Afghanistan. Prefers dry coniferous forests, subalpine scrublands, alpine meadows and agricultural lands.

Medical importance and behaviour: Clinical data on envenoming by this species are lacking but it is considered to be of lesser medical concern in Nepal. It may be active mostly at day and is thought to mainly feed on rodents and lizards.

Venom effects: The venom of this species and its effects have not been studied so far. Envenoming by other species of *Gloydius* usually cause painful local swelling, non-clotting blood, and more rarely bleeding and/or blistering and necrosis at the bite site.



Fig. 81. Himalayan Pit Viper (*Gloydius himalayanus*), adult female from Syang, Mustang District, Nepal, 2700 m altitude.



Fig. 82. Himalayan Pit Viper (*Gloydius himalayanus*), adult female from Syang, Mustang District, Nepal, 2700 m altitude.



Fig. 83. Himalayan Pit Viper (*Gloydius himalayanus*), juvenile with striped pattern from Mustang District, Nepal.

Himalayophis tibetanus

Tibetan Pit Viper, Karan´s Pit Viper, Shah´s Pit Viper (English), Haryou Sarpa, Pattar, Karanko Haryou Sap (Nepali)

Identification: A medium sized viper with pit organ between nostril and eye. Usually 40-70 cm long; hatchlings about 15-20 cm. The large triangular head is very distinct from the neck. The top of the head is covered with small scales. The colour pattern of the body is highly variable. It varies from grass green to yellowish-olive or reddish-brown with irregular reddish-brown pattern or scattered short brown bands along the back. The tail is green with red to brown spots; the belly light green yellowish or light brown, patternless or with dark mottling. Young snakes have a light greyish or brownish ground colour with a dark brown or black pattern along the back and sides. The upper body scales are keeled and arranged in 19-21 rows at midbody. This species was previously also known under the scientific names *Trimeresurus karanshahi* and *Trimeresurus tibetanus*.



F. Tillack

Fig. 84. Tibetan Pit Viper (*Himalayophis tibetanus*), adult male from Phulchoki, Godavari, Lalitpur District, Nepal, 2525 m altitude.

Distribution and habitat: The identity and distribution of this species was poorly known until recently. This is also why it was known under different names in the scientific literature. This is a mountain species that has been found in central Nepal at Phulchoki mountain and Helambu area of Sindhupalchok District from 2500-2700 m altitude; also in neighbouring areas of China (Tibet) up to 3200 m. It prefers oak and rhododendron forests and bush thickets and large rocky grass slopes.

Medical importance and behaviour: Clinical data on envenoming by this species are lacking but it is so far considered to be of lesser medical concern. It may be active at day and night and probably feeds on rodents.

Venom effects: The venom of this species and its effects have not been studied so far. Envenoming by other green pit vipers usually causes painful local swelling, non-clotting blood, and more rarely bleeding and/or blistering and necrosis at the bite site.



F. Tillack

Fig. 85. Tibetan Pit Viper (*Himalayophis tibetanus*), adult female from Phulchoki, Godavari, Lalitpur District, Nepal, 2650 m altitude.



Fig. 86. Tibetan Pit Viper (*Himalayophis tibetanus*), adult female from Phulchoki Mountain, Godavari, Bagmati, Nepal, 2670 m above sea level.



Fig. 87. Tibetan Pit Viper (*Himalayophis tibetanus*), adult female of the brown variety, Tark Ghyang, Helambu, Bagmati, Nepal, 2560 m above sea level.



F. Tillack

Fig. 88. Tibetan Pit Viper (*Himalayophis tibetanus*), subadult female from Melamchigaon, Helambu, Sindhupalchok District, Nepal, 2590 m altitude.



F. Tillack

Fig. 89. Tibetan Pit Viper (*Himalayophis tibetanus*), recently hatched juvenile from Helambu, Sindhupalchok District, Nepal.

Ovophis monticola

Mountain Pit Viper (English), Andho Sarpa, Gurube, Chhirbire Sarpa (Nepali)



Fig. 90. Mountain Pit Viper (*Ovophis monticola*), subadult specimen from Naudanda, Kaski District, Nepal, 1400 m altitude.

Identification: Usually 0.5-1.1 m (up to 1.3 m) long, hatchlings about 16-21 cm. Head triangular in shape and very distinct from the neck. Pit organ present between nostril and eye. Numerous small and smooth scales on top of the head; top and sides of the head dark brown. Upper side of body light or dark brown with a series of large rectangular blotches and irregularly distributed dark brown or yellowish brown spots; body sides with smaller dark brown blotches. Body scales smooth or weakly keeled; arranged in 23-25 (rarely 21 or 26) rows at midbody.

Distribution and habitat: In Nepal wide-ranging in the hills and mountains from 900-2680 m altitude. Also in India, Bhutan, Myanmar, China and Southeast Asia. Found in oak, rhododendron and coniferous forests, grasslands, often in agricultural lands, and in and around houses.

Medical importance and behaviour: One of the most widely distributed and frequently encountered venomous snake species of Nepal and probably the medically most important snake species of the highlands. Ambush predator feeding on rodents, frogs, lizards and birds. Usually active at night, dawn and dusk. Sluggish but highly aggressive when disturbed. Although mild local envenoming seems to be most common, bites by juveniles have caused severe prolonged bleeding, and long-term sequelae and fatalities have been recorded.

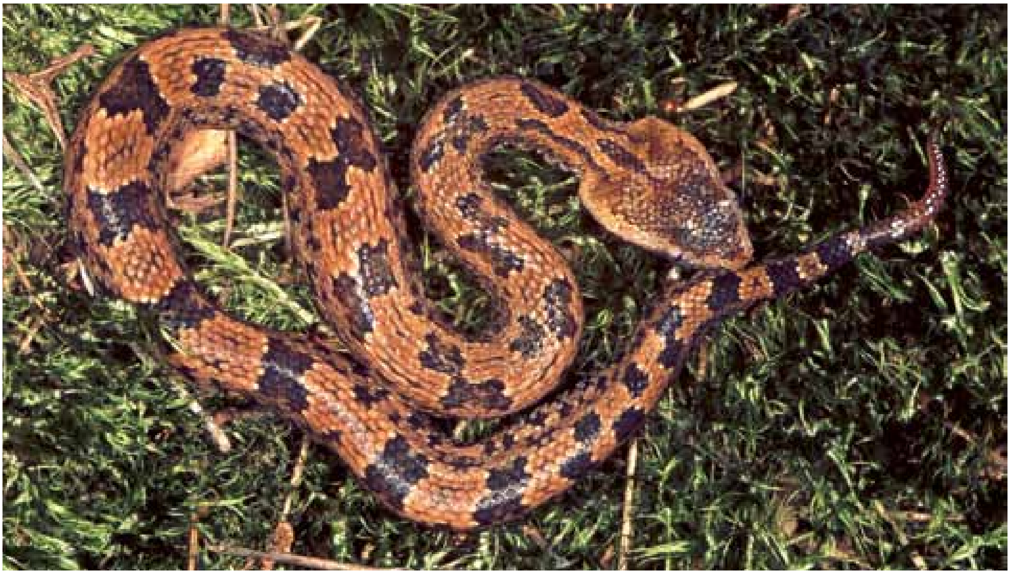
Venom effects: Envenoming by *O. monticola* can cause painful local swelling, non-clotting blood, internal and external bleeding and related complications. Local envenoming may result in massive loss of body fluids into tissues, and in blistering and necrosis requiring surgical intervention.


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Fig. 91. Mountain Pit Viper (*Ovophis monticola*), close-up view of the head of an adult female from Kaski District, Nepal.


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Fig. 92. Mountain Pit Viper (*Ovophis monticola*), female with eggs from between Naudanda and Tulakhet, Kaski District, Nepal.



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Fig. 93. Mountain Pit Viper (*Ovophis monticola*), one year old specimen from Kaski District, Nepal.



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Fig. 94. Mountain Pit Viper (*Ovophis monticola*), juvenile specimen, near Naudanda, Kaski District, Nepal.

Protobothrops sp.

Himalayan Habu Pit Viper (English)

Identification: A large viper with pit organ between nostril and eye and a lance-shaped head that is very distinct from the neck. Usually 1.1-1.4 m long. Upper body yellowish-olive or olive brown, with a series of 42-50 irregularly shaped reddish brown bands (sometimes broken at the sides) with black and yellow borders. Head dark reddish-brown above without pattern, amber or yellowish at the sides below the eye. Belly cream or yellowish-grey with numerous dark brown spots in chessboard-like pattern. Scales on top of the head small and smooth. Body scales strongly keeled (except outer 2-3 rows) and arranged in 24-25 rows at midbody.



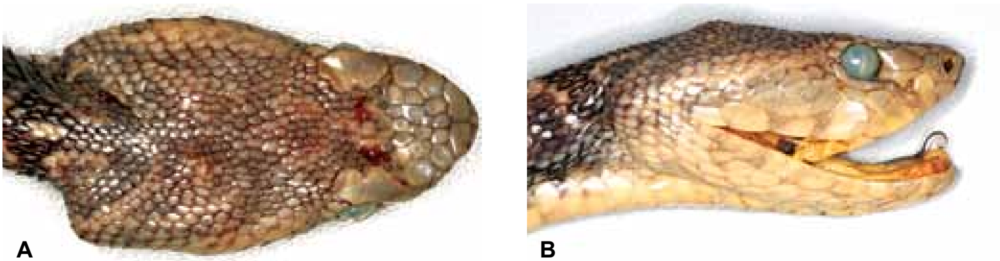
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Fig. 95. Himalayan Habu Pit Viper (*Protobothrops* sp.) from Dolakha District, Nepal, 2600 m altitude, viewed from above. Preserved museum specimen courtesy of California Academy of Sciences (CAS 90668).

Distribution and habitat: The identity and distribution of this species is poorly known in Nepal where it has so far only been found in Simigaon, Dolakha District at 2600 m altitude. Similar species of *Protobothrops* pit vipers inhabit forests, scrublands and the banks of small streams in the mountains of northeastern India, Bhutan, Myanmar, China, and northern Southeast Asia.

Medical importance and behaviour: No proven bites by this species have been recorded in Nepal. However, envenoming by these snakes has to be regarded as potentially extremely dangerous due to their large size and venom quantity.

Venom effects: Envenoming by other species of *Protobothrops* pit vipers has caused painful local swelling, non-clotting blood, internal and external bleeding and cardiovascular shock, myotoxicity with myoglobinuria and renal failure. Local envenoming may result in massive loss of body fluids into tissues, and in blistering and necrosis requiring surgical intervention.



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Fig. 96. Himalayan Habu Pit Viper (*Protobothrops* sp.) from Dolakha District, Nepal (CAS 90668). Note the numerous small scales on top of the head (A). Head of the same specimen viewed from the side (B).



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Fig. 97. Himalayan Habu Pit Viper (*Protobothrops* sp.), same specimen (CAS 90668) viewed from below.

Trimeresurus cf. *albolabris*

White-lipped Pit Viper (English), Haryou Sarpa, Pattar (Nepali)

Identification: A medium-sized viper with pit organ between nostril and eye. Usually 50-70 cm, rarely up to 1 m long, juveniles about 12-18 cm. The large triangular head is very distinct from the neck. The top of the head is covered with many small and smooth scales. Body colour bright green, eye amber or yellow, edges of lip scales bordering the mouth often white. Tail above with continuous reddish-brown colour, belly yellowish-white. Body scales keeled, arranged in 21 rows (rarely 19 or 23) at midbody.

Distribution and habitat: Found throughout the southern lowlands, hills and low mountains. Together with *Ovophis monticola* the most commonly encountered pit viper of Nepal. Elsewhere in the lower elevations of the eastern Himalayas (India and Bhutan). Inhabits open subtropical and tropical forests, grasslands, agricultural lands and residential areas surrounded by vegetation; mostly lives in trees, shrubs and small bushes.

Medical importance and behaviour: Although proven cases of envenoming by this species are rare, it is believed to be one of the most common causes of snake bite in low and intermediate elevations of Nepal. Frequently found active on the ground especially at night, hunting rodents, frogs, lizards and small birds and occasionally entering houses. Usually a gentle snake relying on its camouflage but defending itself quickly with bites when touched or approached closely.

Venom effects: Envenoming by this and other closely related pit viper species usually causes painful local swelling, non-clotting blood, and rarely systemic bleeding and/or blistering and necrosis at the bite site. Serious complications and fatalities are rare.

Note: Several species of "green pit vipers" that look very similar to this species and *T. septentrionalis* have been reported in the Himalayan region (e.g. *gramineus*, *erythrurus* and *yunnanensis*). In most cases, their real identity and occurrence in the region is insufficiently documented and records from Nepal have so far proved unfounded.



A. Gumprecht, specimen courtesy of Fuhlrott Museum

Fig. 98. White-lipped Pit Viper (*Trimeresurus* cf. *albolabris*). Adult snake from southern Nepal.

Trimeresurus septentrionalis

Kramer's Pit Viper (English), Haryou Sarpa, Pattar (Nepali)


F. Tillack

Fig. 99. Kramer's Pit Viper (*Trimeresurus septentrionalis*), adult female from Dhikur Pokhari, Kaski District, Nepal, 1500 m altitude.

Identification: A medium sized viper with pit organ between nostril and eye. Usually 50-75 cm long, juveniles about 15-20 cm. The large triangular head is very distinct from the neck. The top of the head is covered with many small and smooth scales. Body colour dark green, head below the eye light green or yellowish, eye yellow. Tail above bright red, belly light yellowish-green. Body scales keeled, arranged in 21 rows at midbody. This species is also known as *Trimeresurus albolabris septentrionalis* in the older literature.

Distribution and habitat: Common in the mid-hill regions of Nepal (Myagdi, Kaski, Lamjung, Rasuwa) where it inhabits scrublands, bamboo thickets, agricultural lands and forests from 900-3050 m altitude. Outside Nepal reliable records of this species are only known from north-western India (Uttarakhand).


F. Tillack

Fig. 100. Kramer's Pit Viper (*T. septentrionalis*), adult female from Pyaudi, Kaski District, Nepal, 1050 m altitude.

Medical importance and behaviour: Clinical data on proven cases of envenoming by this species are rare but it is believed to be a common cause of snake bite where it occurs in Nepal. Mostly active at night and thought to mainly feed on rodents and frogs.

Venom effects: The venom of this species and its effects have not been studied so far. Envenoming by other closely related "green pit vipers" usually causes painful local swelling, non-clotting blood, and more rarely bleeding and/or blistering and necrosis at the bite site. Such clinical conditions have also been observed in patients from areas in Nepal where *T. septentrionalis* is known to occur.



F. Tillack

Fig. 101. Kramer's Pit Viper (*Trimeresurus septentrionalis*), adult female from Pyaudi, Kaski, Gandaki, Nepal, 1050 m altitude. Note the small scales on top of the head and the pit organ between the eye and the nostril.



F. Tillack

Fig. 102. Kramer's Pit Viper (*Trimeresurus septentrionalis*), adult female from Pyaudi, Kaski, Gandaki, Nepal, 1050 m altitude. Note the reddish-brown colour on the back of the tail.

Other venomous snakes

In addition to the members of these two groups, one species of snake among the many that have enlarged teeth only in the rear of the mouth is also included here, the Red-necked Keelback (*Rhabdophis subminiatus*). Numerous species of snake with such a "rear-fanged" type of dentition occur in Nepal, and they are generally regarded as harmless or only mildly venomous. However, this particular one is known to have caused serious envenoming in humans. All of the few known bites by this species happened in other countries, and in people who handled the snakes on purpose. Often, the bitten persons even let these snakes chew on the bite site for several minutes, unknowingly allowing them to inject larger amounts of their toxic oral gland secretion into the wound. In the context of Nepal, no case of envenoming by this species or any other rear-fanged snake has been reported. Still, the Red-necked Keelback is included in this book because its bite can cause life-threatening envenoming. Its case should serve as a warning to treat all snakes with respect, not to play with snakes (and not to let children play with them), and to seek medical advice if unusual things happen after the bite by any snake.



F. Tillack

Fig. 103. Red-necked Keelback (*Rhabdophis subminiatus*). Adult female from Khao Lak, Phang Nga, Thailand.

Rhabdophis subminiatus

Red-necked Keelback (English)

Identification: Usually 75-95 cm (up to 1.3 m) long, hatchlings about 13-19 cm. Head, body and tail with olive, light brown or greenish tan ground colour. Back of the neck with orange to red colour. Distinct oblique black bar below the eye. Scales across the back arranged in 19 rows at midbody, all but those of the outer rows strongly keeled.



F. Tillack

Fig. 104. Red-necked Keelback (*Rhabdophis subminiatus*) from Khao Lak, Phang Nga, Thailand.

Distribution and habitat: So far recorded from Chitwan District (200 m altitude) only but likely to occur throughout the lowlands of Nepal. Also from north-eastern India and Bangladesh east to China and south to Indonesia. Prefers wet habitats and vicinity of water (e.g., ponds, streams, rice fields, swamps).

Medical importance and behaviour: *Rhabdophis subminiatus* belongs to the large and mostly non-dangerous group of freshwater snakes. It

is active at day, feeds on frogs and fishes, and has enlarged teeth approximately at the level of the eyes that enable it to inoculate highly active venom. When cornered, these snakes raise their head and neck, presenting a narrow "hood" with red colouration. They readily bite to defend themselves. This species has the potential to kill humans. The longer the snake is allowed to chew on the bite site, the higher the risk that significant envenoming will follow. There have been no confirmed bites by *R. subminiatus* in Nepal but cases of life-threatening envenoming have occurred in other countries.

Venom effects: Envenoming by this species has caused headache, nausea, vomiting, thrombocytopenia, erythrocyte fragmentation, and profuse internal and external bleeding with non-clotting blood over weeks. *Rhabdophis subminiatus* venom may be neutralized by *Rhabdophis tigrinus* antivenom made in Japan.



F. Tillack

Fig. 105. Red-necked Keelback (*Rhabdophis subminiatus*). Although it does not belong to the front-fanged venomous snakes, bites by this species can cause life-threatening bleeding.

Management of Snake Bite

Introduction

- Snake bite is one of the most neglected public health problems in poor rural communities in subtropical and tropical countries.
- It is an important occupational injury affecting farmers, plantation workers, herders, and fishermen.
- South Asia is the most affected region in the world.
- In southern Nepal, up to 162 persons per 100,000 people die from snake bite every year in certain regions of the country.

Clinical Features of Snake Bite

- The majority of snake bites are caused by non-venomous species.
- Even highly venomous snakes often bite without injecting any venom.
- Fear, particularly the fear of death, may produce symptoms that can mimic systemic envenoming.
- Use of a tourniquet may lead to a swollen and damaged limb even in the absence of envenoming.
- Clinical features of envenoming depend on the species of snake, the quantity of venom injected and the composition of the venom. Envenoming by juvenile and adult snakes of certain species can also cause different clinical features.
- **Cobra and Krait Bites**
    - ➢ Krait bites usually occur at night on sleeping people (often, but not only on those sleeping on the ground) and may go unnoticed, so that early morning pain in the abdomen with features of paralysis of the eye muscles (difficulty to open the eyes) require urgent care.
    - ➢ Cobra bites usually occur in the daytime in Nepal, especially at dawn and dusk.

- Envenoming due to cobra and krait bites manifests itself predominantly with neuromuscular paralysis (neurotoxicity):
  - Ptosis – inability to open the eyes on looking up
  - Inability to open the mouth
  - Inability to protrude the tongue from the mouth
  - Inability to swallow
  - Paralysis of the muscles of the hands and feet
  - Difficulty in breathing
- Choking and inability to breathe may also result from the pooling of secretions from the mouth, aspiration of vomitus, or blocked airway by a paralyzed tongue.
- Local swelling, local infection, abscess formation and local tissue damage (necrosis) is one of the important features of cobra envenoming.

- **Viper Bites**
  - The most common serious complication of viper bite envenoming is bleeding.
  - Bleeding from gingival sulci is usually the earliest sign of systemic envenoming.
  - Other common sites of bleeding are partially healed wounds or venepuncture sites.
  - In severe envenoming, bleeding from any site is possible. Ecchymoses (bleeding under the skin), subconjunctival bleeding (in the eye), intraperitoneal haemorrhage (bleeding inside the abdomen), subarachnoid and intracranial hemorrhages (bleeding inside the skull and into the brain) may occur.
  - Local complications at the bite site are common and may include swelling, blisters, necrosis of the skin, soft tissues, connective tissues and muscles.

First Aid

- Any person who happens to be nearby at the time of a snake bite, or the victim himself, should carry out first aid.
- Reassure the victim; most are terrified and apprehensive.
- Immobilization of the bitten limb is an important and effective first aid measure. Allow the victim to lay down in a comfortable and safe position.
- Immobilize the bitten limb with a splint or sling.
- Immediately transport the victim to the nearest health centre where antivenom (anti-snake venom serum) is available. This is the most important first aid measure. Transport by motorcycle or other motor vehicles is key to save time.

Management at the Health Centre

- If the victim has no sign of envenoming, admit the patient and observe for 24 hours. If signs of systemic or severe local envenoming are present on admission or develop later, treatment with antivenom and other supportive care is the key to the survival and cure of the patient.
- Early assisted ventilation (manually by Ambu bag or mechanically) is crucial to treat patients with respiratory paralysis. It may be required for days or weeks but full recovery is possible if adequate oxygen levels were maintained.
- **Immediate Management**
    1. Assess vital signs, resuscitate if necessary and insert an intravenous line.
    2. Evaluate for the presence of features of local envenoming.
    3. Look for signs of neuromuscular paralysis or bleeding (other than from the bite site).
    4. Certain clinical situations demand urgent resuscitation, e.g., presence of profound hypotension and shock or respiratory failure.
    5. Pay careful attention to the pre-admission history, closely observe the patient and be prepared for rapid development of severe systemic envenoming and sudden deterioration.

6. Snake bite envenoming, especially by kraits, can produce clinical features that resemble brain death, like fixed dilated pupils and invisible spontaneous respiration. These patients are paralysed and can fully recover if adequately ventilated (manually or mechanically).

- **Indications for Antivenom Injection**
  1. Signs of neuromuscular paralysis (drooping of eyelids, inability to open the mouth or other signs described above).
  2. Spontaneous bleeding.
  3. In proven cases of Russell's Viper bite: incoagulable (non-clotting) blood.
- **Dose of Antivenom**
  - ➢ Snakes inject the same dose of venom into children and adults. Children must therefore be given exactly the same dose of antivenom as adults.
  - ➢ Patients with signs of systemic envenoming should be treated with antivenoms (also known as anti-snake venom serum) according to the local protocol.

Prevention of Snake Bite

Many snake bites could be prevented by simple measures that aim to reduce the likelihood of human-snake encounters, and to reduce the chances of being bitten when meeting a snake.

- Keep it clean around the house and playground without bushes, stones, mud, and piles of leaves.
- Keep everything away from the house (or in sealed containers) that could attract mice and rats. If mice or rats are in or around the house, snakes will be attracted by their presence.
- Close holes in the ground or walls in or around the house. These may be used by snakes as hiding places or to enter the house or may be the home of mice or rats.
- Wearing long clothes and boots (if practical) may help to protect from envenoming if bitten.
- Always use a torch or other light sources while walking in the dark of night.

- Be careful while working on stones or wood as snakes may be hidden under rocks and branches or fallen trees.
- Children should be advised not to play in localities where snakes are known to be especially common.
- Try to know the species of snake that are venomous and non-venomous in the area where you live.
- Avoid sleeping on the ground – indoors as well as outdoors. Many snake bites, especially by kraits, occur on people who sleep on the ground at night.
- Proper use of a mosquito net may help to prevent snake bites. If the mosquito net is well tucked under the mattress and has no holes, snakes cannot get onto the sleeping place.
- Look under your pillow and blankets before going to bed - sometimes a snake is hidden there.
- Use beds on poles and do not put the bed next to structures that snakes could use to climb up, like house walls made of straw, bamboo or wood.
- If you are sleeping under a tent, its door should be closed properly.


S.K. Sharma

Fig. 106. Bilateral ptosis in neurotoxic snake bite envenoming. Due to the effects of the snake venom, the patient is unable to lift the eyelids. She also can no longer fully open the mouth because her jaw muscles are paralysed. This also affects the ability to speak.



Fig. 107. Consequences of the use of a tight tourniquet. Many people tightly apply ropes or other materials to a bitten limb hoping to slow down the spread of venom. However, this practice in itself can cause severe damage even in the absence of venom, by obstructing the blood flow, and may result in the need for amputation. It also aggravates the local destruction of tissues by cobra, viper and pit viper venoms.



Fig. 108. Sequelae of local snake bite envenoming. Cobra, king cobra, pit viper and Russell's Viper venoms are known to cause significant local envenoming that may lead to necrosis and loss of tissues. Contractures of digits as shown here or the amputation of fingers, toes or entire limbs are the most common long-term consequences. Permanent disability following snake bite envenoming puts a heavy burden on families in the rural areas. Early and effective medical treatment can reduce the extent and severity of local snake bite envenoming.



Fig. 109. Mild local swelling after the bite of a green pit viper near Damak, Jhapa, Nepal. In Nepal, painful swelling of the bitten body part is a characteristic feature of envenoming by pit vipers and vipers, and by cobras.



Fig. 110. Gum bleeding after snake bite. In Nepal, coagulation defects and spontaneous bleeding have been observed following bites by pit vipers like the Mountain Pit Viper (*Ovophis monticola*). However, this is also characteristic after bites by Russell's Viper (*Daboia russelii*), here in a case from India, which is a comparatively rare snake in Nepal.



Fig. 111. "Broken neck" sign observed in a girl bitten by a snake. Envenoming by cobras and kraits (in some areas also by Russell's Viper) frequently leads to progressive descending paralysis. Looking for the broken neck sign, which is caused by paralysis of the neck flexor muscles, should be part of the routine clinical assessment of patients. In this case from India, the envenoming was caused by Russell's Viper (*Daboia russelii*).



Fig. 112. Envenoming by kraits and cobras frequently results in respiratory paralysis. In these cases, early assisted ventilation is life-saving. Here it is performed manually using an Ambu bag on a paralysed patient bitten by a Common Krait (*Bungarus caeruleus*).

Selected additional information resources

Guidelines for the Management of Snake Bites (South and South-East Asian regions), published by the World Health Organisation - Regional Office for South-East Asia (WHO/SEARO). A free download of the 2010 edition by D. A. Warrell is available from:

http://www.searo.who.int/catalogue/2005-2011/pdf/bloodsafety/guidelines_snakebites.pdf

VAPAGuide - Emergency Guide to Venomous and Poisonous Animals. This free internet-based resource by T. Junghanns and M. Bodio on venomous and poisonous animals and the clinical management of envenoming and poisoning is available at:

http://www.vapaguide.info

Clinical Toxinology Resources Website. This internet-based resource on clinical toxinology and venomous and poisonous animals is maintained by J. White and colleagues at the Toxinology Department of the Women's & Children's Hospital (WCH) in Adelaide, Australia, and is available at:

http://www.toxinology.com

Snake bite in South Asia: a review. This review article by E. Alirol, S. K. Sharma, H. S. Bawaskar, U. Kuch and F. Chappuis covering 122 literature references on snake bite in South Asia is available free from the web site of the journal PLoS Neglected Tropical Diseases:

http://www.plosntds.org/article/info%3Adoi%2F10.1371%2Fjournal.pntd.0000603

WHO Guidelines for the Production, Control and Regulation of Snake Antivenom Immunoglobulins. These World Health Organisation guidelines and additional important information are available at:

http://www.who.int/bloodproducts/snake_antivenoms/en

WHO Database on Snake Antivenoms and Venomous Snakes. This searchable database provides information on existing snake antivenom immunoglobulin products and snakes of medical importance, distribution maps and photographic references. It is available at:

http://apps.who.int/bloodproducts/snakeantivenoms/database/default.htm

Global Snake Bite Initiative (GSI)

http://www.snakebiteinitiative.org

International Society on Toxinology (IST)
http://www.toxinology.org

Snakes of India – The Field Guide by R. Whitaker and A. Captain. Draco Books (Chennai); 2008, 495 pp.

Snake bite Management Guideline (in both Nepali and English) by K. B. Shah, J. M. Shrestha and C. L. Thapa. HMG's Ministry of Health, Department of Health Services, Epidemiology & Disease Control Division (Kathmandu); 2003, 56 pp.

Amphibians and Reptiles of Nepal by H. H. Schleich and W. Kästle (Ed.). A.R. Gantner Verlag (Ruggell); 2002, 1295 pp.

Herpetofauna of Nepal: A Conservation Companion by K. B. Shah and S. Tiwari. IUCN - The World Conservation Union (Kathmandu); 2004, VIII + 237 pp.



N.L. Orlov

Fig. 113. MacClelland's Coral Snake (*Sinomicrurus macclellandi univirgatus*), adult female from Rakse, Ilam, Mechi, Nepal, 2300 m above sea level.

Motorcycle volunteer programme to minimize deaths related to snake bite

The motorcycle volunteer programme is a network of motorcycle owners in remote lowland villages of eastern Nepal. Volunteers serve around the clock transporting suspected or proven snake bite victims as quickly as possible to the nearest hospital or healthcare centre where facilities for snake bite treatment exist. The snake bite victim is held firmly between the motorcycle driver and an assistant pillion-rider to prevent the patient falling from the vehicle during transport (see below). This programme precedes awareness programmes and emphasizes earlier transport of the victim to an appropriate snake bite treatment centre by motorcycle. It also provides educational messages and simple slogans such as

"bitten by snake – catch motorcycle volunteers – reach nearby snake bite treatment centre – save life!"

It helps in minimizing snake bite related deaths.



जानी राखौं

- समयमै उपचार गरे विषालु सर्पले डसे पनि मानिसको ज्यान बचाउँन सकिन्छ।
- सर्पले डसेको थाहा पाउँन बित्तिकै अथवा शंका मात्र लागे पनि सम्बन्धित उपचार केन्द्रमा पुग्नाले अकालमै ज्यान जानबाट बच्न सकिन्छ।
- विषालु सर्पले डसेर मर्ने कारणहरु मध्ये समयमै उपचार गर्ने ठाउँमा नपुग्नु प्रमुख हो।
- धामी, झांक्री, झार-फुक, जडी-बुटीको विश्वास गर्दा अनावश्यक समय खेर गई मृत्यु हुने निश्चित प्रायः छ।

त्यसैले

- सर्पले डस्ने बित्तिकै नजिकको उपचार केन्द्रमा तुरुन्तै लैजाऔं।

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